ATTACHMENT 1
WASTE ANALYSIS PLAN

1.0 INTRODUCTION

Attachment 1 presents the waste analysis plan (WAP) for range recovered munitions (RRMs) that are believed to contain chemical warfare materiel (CWM). The WAP details the hazardous waste characterization process for items stored in Igloo G.

1.1 Objective

The primary objective of the WAP is to facilitate compliance with applicable Federal and State environmental protection laws and regulations for characterizing hazardous waste for storage at Dugway Proving Ground's (DPG's) Igloo G.

Hazardous waste at DPG is generated in support of the DPG mission by U.S. Army (Army) personnel, Army contractors, and tenants of the installation. To comply with Resource Conservation and Recovery Act (RCRA) hazardous waste generator requirements, DPG must obtain a detailed characterization of any hazardous waste that is generated at the installation. This characterization is based on generator knowledge and/or chemical and physical analyses of a representative sample of the hazardous waste. The waste analysis requirements, as documented in this WAP, ensure that sufficient information is known about each waste stream so the wastes may be properly managed.

1.2 Regulatory Requirements

The Igloo G WAP must follow the applicable Federal and State environmental regulations listed in Utah Administrative Code (UAC) R315-8-2.4, cross referenced in 40 Code of Federal Regulations (CFR) 264.13. These regulations require the WAP to include the following specifications.

- The parameters for which each hazardous waste will be analyzed and the rationale for selecting these parameters (i.e., how analysis of these parameters will provide sufficient information on the waste's properties to properly treat, store, and dispose of these wastes).

- The approved analytical methods which will be used to test for these parameters.

- The sampling method which will be used to obtain a representative sample of the waste. (These methods must be a method listed in UAC R315-50-6 and cross-referenced in 40 CFR 261 Appendix I or an equivalent sampling method.)

- The frequency with which the initial characterization will be reviewed or repeated to ensure that the characterization is accurate and current.

- If applicable, the methods that will be used to meet the additional waste analytical requirements for ignitable, reactive, or incompatible wastes specified in UAC, R315-8-2.8 and cross-referenced in 40 CFR 264.17.

2.0 WASTE ANALYSIS PLAN FOR HAZARDOUS (NON CHEMICAL AGENT AND N0N-MILITARY AGENT-RELATED) WASTE

Igloo G does not store any non-chemical agent-related wastes. Therefore, non-chemical non-military agents shall not be stored at Igloo G. The Igloo G WAP does not address waste acceptance for non-chemical agent related wastes.

3.0 WASTE ANALYSIS PLAN FOR RANGE RECOVERED MUNITIONS STORED IN IGLOO G 40 CFR 270.14(b)(3), 264.13(b) -(c), 264.17; R315-3-5(b)(3), R315-8-2.4(b)-(c)

The plan for waste analysis for CWM-filled RRMs is organized into the following sections:

- Waste Acceptance Characterization
- Wastes
- Waste Analysis Parameters and Methods
- Sampling Method
- Laboratory Testing and Analytical Methods
- Frequency of Analysis
- Special Procedural Requirements

3.1 Waste Acceptance Characterization R315-8-2.4

The historical testing of munitions involved test-firing projectiles on various ranges located in the western part of DPG. Munitions tested at DPG were filled with one or more of the following:

- Conventional explosives
- CWM
- Industrial chemicals used as warfare agents
- Industrial chemicals used to simulate CWM
- Riot control agents
- Incendiary agents
- Smoke and obscurant agents

Because of the soft soil at DPG, many of the test items impacted and penetrated the soil surface and remained buried and relatively undamaged. Soil heaving from frost and soil erosion occasionally brings a buried projectile to the surface over a period of time. DPG generates hazardous waste when the unexploded projectiles, known as RRMs, are recovered by the explosive ordnance disposal (EOD) personnel during range clearing operations or as part of the Installation Restoration Program. Most munition items found on the range are conventional munitions; however, some are chemical-filled projectiles. When a RRM is discovered, the EOD will conduct a field assessment to determine if the RRM might contain a CWM fill. If the RRM is suspected of containing a CWM fill, Dugway Directorate of Environmental Programs (DEP) will review the field assessment data and will accept or reject the characterization. The EOD and the Quality Assurance Specialist Ammunition Surveillance (QASAS) then will assess each RRM and determine

whether it is safe to transport and store. If the RRM is deemed safe to transport and store and the Dugway DEP characterization, based upon the EOD field assessment determines that it may be filled with CWM, the RRM is transported to Igloo G for storage. Conventional ammunition items are recovered and transported to the Open Burn/Open Detonation Area for treatment or temporary storage prior to treatment. RRMs that are unsafe to transport are destroyed in place under provisions contained in an emergency plan approval.

Before drill and transfer operations are initiated, a permit modification and plan will be submitted for Utah Division of Solid and Hazardous Waste (UDSHW) approval.

3.2 Wastes: 40 CFR 261; R315-2-9 through R315-2-11

RRMs that contain CWM are classified as P999 hazardous waste.

Igloo G is used to store CWM-filled RRMs and other CWM-filled containers. RRMs that are explosively configured and contain certain other historic military agents such as phosgene and cyanogen chloride may also be stored in Igloo G. Additional characteristic and/or listed waste codes may apply due to physical characteristics and/or chemical compounds that are associated with munitions and CWM. Waste codes that may also apply to RRMs found on DPG are: D001, D002, D003, D004, D021, D028, D030, D034, D039, D040, P033, P095, P999, F999, and U125. Each RRM will be individually characterized using the waste analysis methods described in Section 3.3. DPG is permitted to store D001, D002, D003, D004, D021, D028, D030, D034, D039, D040, P033, P095, U125, F999, and P999 hazardous waste.

Some of the RRMs stored in Igloo G contain portions of the explosive train, such as fuzes and explosive bursters. If explosive components are present, the RRM is also a reactive (D003) hazardous waste. Specific type and exact composition of these components (i.e., explosive chemical name(s)) are not determined for each RRM since many RRMs have obscured or ambiguous identifying marks and because most items tested at DPG were research and development items, not manufactured end products.

3.3 Waste Analyses Parameters and Methods: 40 CFR 264.13(b)(1) and (b)(2); R315-8-2.4(b)(I)

Since RRMs are likely to contain high explosives and/or CWM and are therefore inherently dangerous. Nonintrusive methods are preferred to identify the components of the RRM for the purpose of storing the munitions. The process for assessing suspect chemical RRMs is very standard, however, the process may vary when unusual RRMs are encountered (e.g. very large bombs, very small bomblets).

Since physical contact is not made with the contents of the RRM, the assessment process is used to determine:

- The presence or absence of a liquid (potential CWM) within the RRM
- The presence and stability of energetics
- The presence of key elements in ratios that are indicative of CWM

The RRM assessment process consists of the methods discussed in the following sections:

- Research of Historical Information
- X-ray Analysis
- Portable Isotopic Neutron Spectroscopy (PINS)
- Munitions Assessment Review Board (MARB)

3.3.1 Research of Historical Information

EOD personnel respond to the discovery of an RRM on the range. EOD personnel determine the type and size of the RRM (e.g. 155-millimeter howitzer, 4.2-inch mortar, etc.). EOD personnel also examine the RRM to determine if it has any markings such as date or location of manufacture, lot or serial numbers, fill type, etc. Location of discovery is recorded and compared against historic documentation and manuals, which provide information about the munitions that are currently, or were previously, maintained in the U.S. military inventory. Disposition records, accountability records, test plans, test reports and other historical information are also reviewed to help determine the background of the RRM. This information aids DPG in determining the fill material present in RRMs.

3.3.2 X-ray Analysis

The X-ray procedure provides a picture of the interior of an RRM. The operator of the X-ray system sees a shadow picture of the inside of an RRM. This shadow picture is based on the differing molecular densities of the RRM components and their respective ability to absorb X-ray spectra. X-ray procedures, described in the standing operating procedure for radiographic operations (Army TEU, 1998) examine munitions to determine:

- Presence and condition of a fuze
- Presence and condition of a burster
- Presence and condition of other portions of an explosive train
- Liquid fill line
- Other internal structures (such as felt wedges, which indicate a white or red phosphorous fill or evidence of ruptured canisters which may indicate a binary munition)

Dugway DEP will decide if a CWM-filled RRM can be stored at Igloo G based on EOD and QASAS field assessment and the RRM will be overpacked for storage. In some instances, additional X-rays may be taken at any point during storage if previous X-rays were not clear enough to distinguish some of the features of the RRM, (DP-0000-F-112, 2000).

3.3.3 Portable Isotopic Neutron Spectroscopy (PINS)

The nonintrusive PINS method, which uses penetrating radiation, relies on the sensitivity of radiation assay to individual chemical elements in an object, but not molecular combinations. PINS use a radioactive source to activate the neutrons in the elements of the item being assayed. Neutrons provide excellent penetrating radiation for chemical munitions and containers since they easily pass through the thick steel casings to induce the required ionization in the chemical agent fill. This ionization generates high-energy gamma rays from the chemical fill, which can escape through the steel casing where they are collected by a detection system. The PINS method measures the gamma rays produced by neutron capture reactions and inelastic neutron scattering reactions within an RRM to identify the elemental nature of its contents.

Both chemical agent and high explosives are organic compounds made up of carbon, hydrogen, and oxygen. High explosives also contain nitrogen. The nerve agents GA, GB, GD, GF and VX and the blister agents H, HD, HT, HL, and Lewisite contain one or more of the elements chlorine, fluorine, sulfur, phosphorus, and arsenic in differing combinations. Each of these elements has a unique gamma-ray energy spectral signature. The respective ratio of these "key elements" is used to determine which, if any, of the chemical warfare agents is present in the item being assayed. When PINS detects a key element, it indicates that a key element has been detected and the confidence level of the detection. Key element data is interpreted by computer algorithm and by PINS experts at the Idaho National Engineering and Environmental Laboratory to determine what, if any, chemical agent may be present in an RRM (PINS Chemical Assay System Users Manual, Version 2.1, Siedenstrang, et.al, 1994). The PINS experts use an analysis decision tree like the one presented in Figure 1-1 to assist in determining the contents of the munition.

The gamma-ray spectra of all stable chemical elements have been measured and cataloged over the past 40 years and have served as important tools for basic and applied nuclear physics research. The interpretation of these spectra is used to aid in the determination of the presence of chemical agent in an RRM. Currently, DPG uses the PINS method described in PINS Chemical Assay System Users Manual, Version 2.1 (Siedenstrang, et.al, 1994). Prior to using a new version of the PINS users manual, DPG will submit a courtesy copy to UDSHW.

3.3.4 Munitions Assessment Review Board (MARB)

The MARB was formed by the U.S. Army Chemical and Biological Defense Command to develop procedures and policies for the nonintrusive investigation and assessment of RRMs that may contain CWM. If the waste analysis procedures show that an RRM has the potential to contain CWM, the RRM is stored in Igloo G. At the periodic meeting of the MARB, data gathered by DPG personnel concerning any RRMs that were recovered since the previous meeting of the MARB are examined. The MARB uses this information to validate the absence or presence and nature of CWM and energetics in each RRM. The MARB makes its decision based on the following three sources of information:

- Historical research of the munition markings, location found, and test plan information

- X-ray analysis of the munition

- PINS evaluation of the munition

Members of the MARB are experts in explosive ordnance disposal, chemical agent munitions, the theory and operation of both the X-ray and PINS systems, and the history of Army chemical agent and ordnance manufacturing and testing. Experts in chemical agent munitions comprise the voting membership of the MARB. The MARB may also draw on additional experts to aid in the decision making process. The MARB's decision is used to support DPG's generator knowledge. DPG may choose to reevaluate their generator knowledge based on the decision of the MARB. As waste identification technology develops, RRMs may be reevaluated periodically to verify the presence of CWM during their storage in Igloo G.

3.4 Sampling Method: 40 CFR 264.13(b)(iii); R315-8-2.4

Each RRM that potentially contains CWM and is found to be safe for transport will be sampled nonintrusively by both X-ray and PINS procedures that are described in Sections 3.3.2 and 3.3.3. No other sampling methods will be used.

3.5 Laboratory Testing and Analytical Methods: 40 CFR 261 Appendix II and III; R315-50-7, R315-50-8

There is no laboratory testing involved in the sampling and testing of RRMs.

3.6 Frequency of Analyses: 40 CFR 264.13(b)(iv); R315-8-2.4

Each RRM will be evaluated by DPG prior to storage in Igloo G. The MARB, at its periodic meetings, reviews the data collected by DPG and validates the assessment of the munition components. Only RRMs, which are believed to contain CWM, will be stored in Igloo G.

3.7 Special Procedural Requirements

This section on special procedural requirements presents procedures relating to:

- Receiving waste from off-site generators
- Ignitable, reactive, and incompatible wastes
- Compliance with land disposal restrictions (LDRs)

3.7.1 Procedures for Receiving Wastes from Off Site Generators: 40 CFR 264.13(b)(5); R315-8-2.4, R315-8-2.4

DPG is requesting to permit Igloo G primarily to store RRMs that are generated at DPG. Because Igloo G is in an isolated location and is designed/permitted to store munitions that contain CWM, DPG may agree to accept munitions from off-site generators that contain or may contain CWM. Munitions containing CWM accepted from off-site generators will be evaluated as described in Section 3.3 if the munition has not already been fully characterized. DPG will ensure that hazardous waste received at Igloo G matches the waste

designated on the accompanying shipping papers or manifest for wastes received from off-site sources.

3.7.2 Procedures for Ignitable, Reactive, and Incompatible Wastes: 40 CFR 264. 17; R315-8-2.4

At no time during the analysis of each RRM will it be exposed to open flames, cutting and welding, hot surfaces, frictional heat, sparks, or radiant heat. The entire Carr Facility, in which Igloo G is located, is designated as a no smoking area.

3.7.3 Procedures to Ensure Compliance with Land Disposal Restrictions: 40 CFR 264.13(a)(1), 268.7; R315-8-2.1, R315-13-1

Current Utah hazardous waste management rules do not set land disposal restrictions for either of the chemical agent-related waste codes, P999 and F999. However, most of the RRMs stored in Igloo G carry additional waste codes or have the potential to carry additional waste codes once physical sampling can be performed. All of the additional waste codes that may apply to the RRMs stored in Igloo G are restricted from land disposal, this would include P095 (Phosgene wastes).

Hazardous wastes restricted from land disposal may be stored for a maximum of 1 year unless it can be demonstrated that additional storage time is necessary to accumulate a sufficient quantity of hazardous waste to facilitate proper recovery, treatment, or disposal of the waste.

In the case of the RRMs stored in Igloo G, no feasible, permitted treatment technology exists at this time to adequately treat non-stockpile CWM stored in munitions. There are two federal statutes that make it impossible to comply with RCRA Section 3004 and 40 CFR 268.50 at this time. The first statute governs the CWM stockpile disposal program and prohibits the transfer of non-stockpile CWM to any stockpile disposal facility such as the Tooele Chemical Disposal Facility in Tooele County, Utah. The second statute requires that the Army detoxify lethal chemical agents prior to disposal, thus eliminating the use of commercial treatment or disposal facilities to dispose of pure or nearly pure CWM. Since the RRMs contain pure CWM they cannot be shipped to commercial facilities and it is not possible to detoxify the CWM as long as it is contained in the munitions. Therefore, until the appropriate treatment technologies are developed by the Army for the non-stockpile program and permitted by the applicable regulatory agencies, munitions containing CWM will be stored in Igloo G. The first of the non-stockpile treatment technologies is currently in the process of obtaining a RCRA Research, Development and Demonstration (RD&D) permit from the State of Utah. The first version of the Munitions Management Device (MMD) will be used to treat small containers of CWM and munitions that do not contain explosive components. The sampling and analysis that are required to comply with LDRs are described in detail in the RD&D permit for the (MMD-1 permit, 1998). Compliance with LDRs will be described in permit applications for each subsequent technology that will be used to treat the remaining contents of Igloo G.

RRMs will be stored until a treatment method is approved. When the final treatment method is determined, the available information regarding LDRs and waste analysis will be provided to the treatment facility.

3.8 Procedures to Ensure Compliance with Air Emission Standards: 40 CFR 264.13(8), 264.1080-1084

Facilities storing containers that have a design capacity greater than 0.1 cubic meters (m^3) and contain volatile organic compounds at a concentration of 500 parts per million by weight of the total organic compounds present are subject to 40 CFR 264.1080 Subpart CC Air Emission Standards for Containers. DPG does not currently store or anticipate storing any RRMs in containers with a design capacity greater than 0.1 m^3. Therefore, Igloo G is not subject to Subpart CC standards.

3.9 Waste Analysis Program Evaluations: 40 CFR 264.13(c); R315-8-2.4

Nonintrusive evaluation of RRMs is a constantly evolving technology. As major improvements are made in nonintrusive evaluation of RRMs, DPG will evaluate incorporating these improvements into the WAP.

Intrusive methods of waste analysis for RRMs present an unacceptable risk to human health and the environment. As a result, only nonintrusive methods of waste analysis are available for waste characterization of RRMs. However, nonintrusive evaluation of RRMs is not capable of providing the specific information that would normally be required for complete waste characterization of RRMs. The WAP as presented in this permit does, however; represent the state of the art in nonintrusive evaluation of RRMs. No other alternatives for nonintrusive waste analysis of RRMs currently exist.

4.0 REFERENCES

CFR (Code of Federal Regulations). Title 40, Part 261, Identification and Listing of Hazardous Waste.

CFR. Title 40, Part 262, Standards Applicable to Generators of Hazardous Waste.

CFR. Title 40, Part 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.

CFR. Title 40, Part 268, Land Disposal Restrictions.

CFR. Title 40, Part 270, EPA Administered Permit Programs: The Hazardous Waste Permit Program.

UAC (Utah Administrative Code) R315-1 to R315-14, R315-50, and R315-101 Utah Hazardous Waste Rules.

Army TEU (U.S. Army Technical Escort Unit). Standing Operating Procedure for Radiographic Operations. SOP No. TU-0000-M-03.

DPG (Dugway Proving Ground). DPG Routine Operating Procedures and Safety requirements for the Phillips G 301 and Baltograph 300D X-Ray. DP-0000-F-112.

Resource Conservation Recovery Act Research Development, and Demonstration Permit for the Munitions Management Device, Version 1, 1998.

Siedenstrang, A.L., K.M. Krebs, J.K. Hartwell, R.J. Gehrke, and A.J. Caffrey. 1994. PINS Chemical Assay System; Users Manual, Version 2.1. Idaho National Engineering Laboratory.

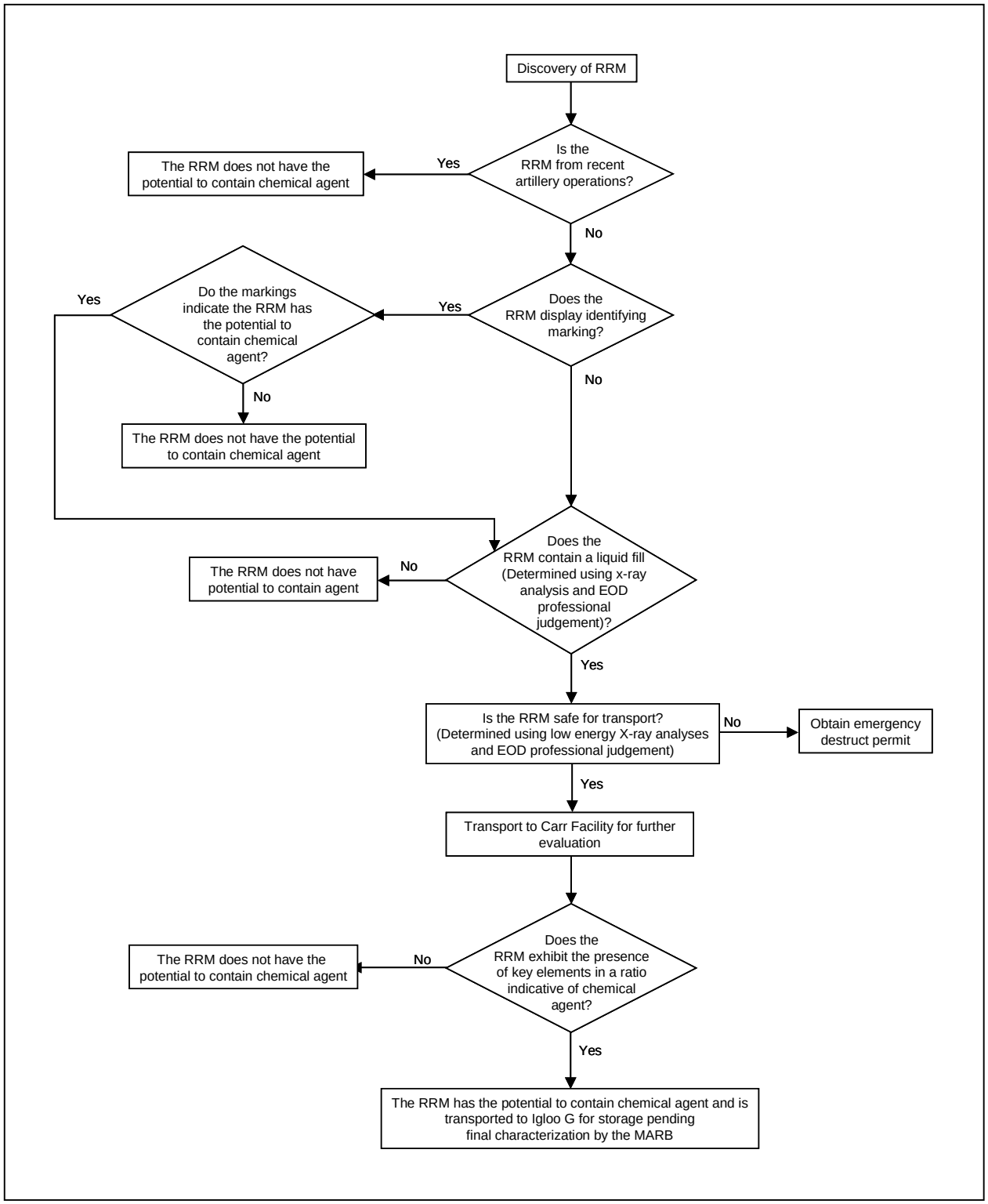

Figure 1-1. Range Recovered Munitions Waste Analysis Process